

XI CLASS BIOLOGY NOTES
CHAPTER 8: CELL - THE UNIT OF LIFE

All organisms are made of cells or aggregates of cells. Cells vary in their shape, size and functions. Based on the presence or absence of a membrane bound nucleus and other organelles, cells can be named as Prokaryotic or Eukaryotic.

Cell is the fundamental structural and functional unit of all living organisms.

Anton Von Leeuwenhoek first observed and described a liver cell.

Robert Brown later discovered the nucleus.

Cell theory – Given by Schleiden and Schwann (later Virchow)

- All living organism are made of cells and their products.
- All cells arise from pre – existing cells.

Characteristic	Prokaryotes	Eukaryotes
Size of cell	Typically 0.2-2.0 μm in diameter	Typically 10-100 μm in diameter
Nucleus	No nuclear membrane or nucleoli (nucleoid)	True nucleus, consisting of nuclear membrane & nucleoli
Membrane-enclosed organelles	Absent	Present; examples include lysosomes, Golgi complex, endoplasmic reticulum, mitochondria & chloroplasts
Flagella	Consist of two protein building blocks	Complex; consist of multiple microtubules
Glycocalyx	Present as a capsule or slime layer	Present in some cells that lack a cell wall
Cell wall	Usually present; chemically complex (typical bacterial cell wall includes peptidoglycan)	When present, chemically simple
Plasma membrane	No carbohydrates and generally lacks sterols	Sterols and carbohydrates that serve as receptors present
Cytoplasm	No cytoskeleton or cytoplasmic streaming	Cytoskeleton; cytoplasmic streaming
Ribosomes	Smaller size (70S)	Larger size (80S); smaller size (70S) in organelles
Chromosome (DNA) arrangement	Single circular chromosome; lacks histones	Multiple linear chromosomes with histones
Cell division	Binary fission	Mitosis
Sexual reproduction	No meiosis; transfer of DNA fragments only (conjugation)	Involves Meiosis

Prokaryotic cell: Bacteria, Blue-green algae, Mycoplasma, PPLP (Pleuro Pneumonia Like Organisms).

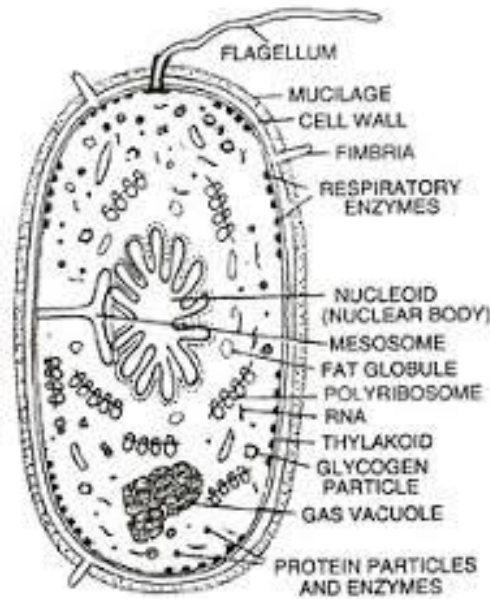
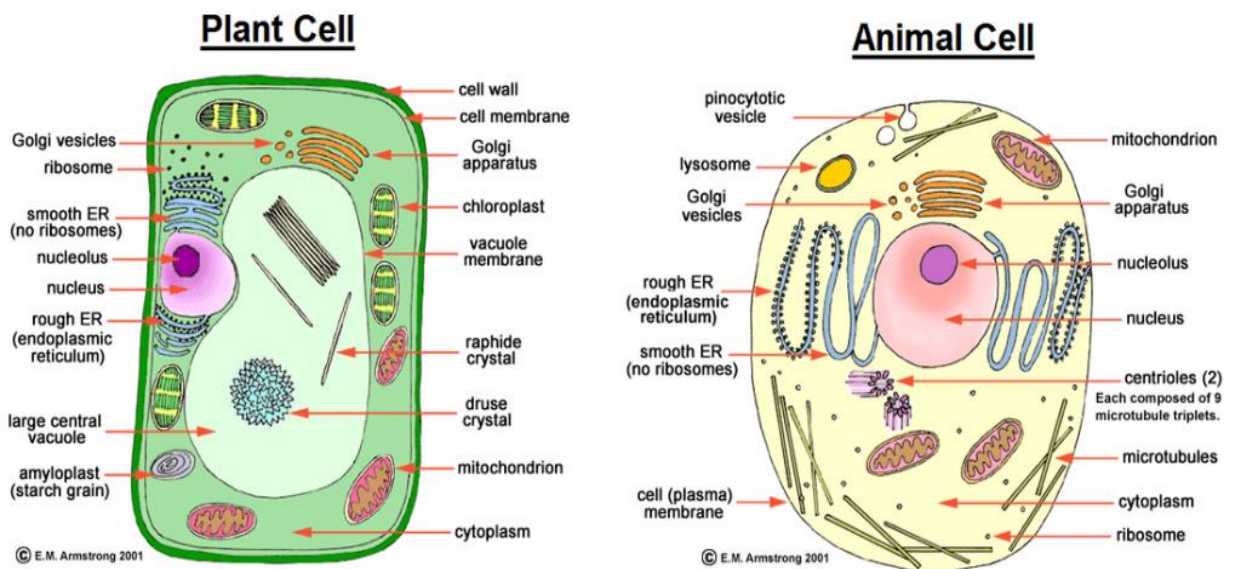


Fig. 8.6. Ultrastructure of a bacterial cell.

Eukaryotic cell:

- Protists, Fungi, Plant cell and animal cell are placed in eukaryotes



Cell wall

It gives shape, mechanical support, cell-to-cell interaction – made of cellulose, hemicelluloses,

pectins (in plants) and cellulose, galactans, mannans, calcium carbonate (in algae).

- Primary cell wall – in young plant cell, capable of growing till cell matures
- Secondary cell wall – formed on the inner side of the cell.
- Middle lamellae – calcium pectate
- The cell wall middle lamellae may be traversed by plasmodesmata which connect the cytoplasm of neighboring cells.

Cell membrane

Cell **membrane** is composed of lipids that are arranged in bilayer. The lipid component is mainly composed of phosphoglycerides. Later it was found that protein is also present in cell membrane. Ratio of protein and lipids varies in different cells. Membrane protein may be integral or peripheral. Integral protein remains buried in membrane but peripheral protein lies on the surface.

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- Singer and Nicholson (1972) proposed **fluid mosaic model**. According to this model the quasi-fluid nature of lipid enables lateral movement of protein within the bilayer of lipids.

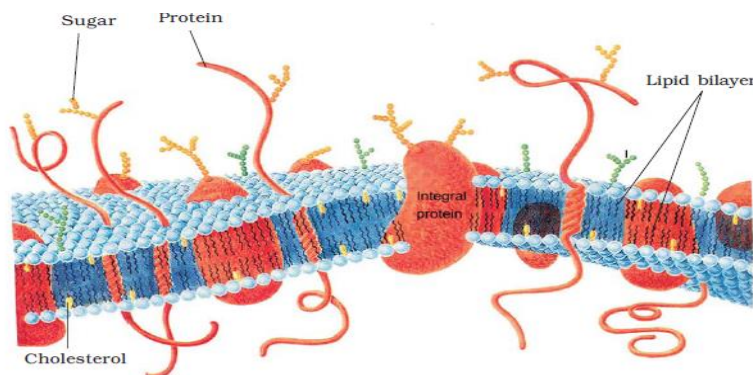


Figure 8.4 Fluid mosaic model of plasma membrane

Endoplasmic reticulum

- SER – no ribosomes on its surface, appears smooth(helps in lipid synthesis/steroids)
- RER – ribosomes are present on its surface, appears rough surface(helps in protein synthesis)

Golgi apparatus –

First observed by Camillo Golgi - packaging unit - makes glycoprotein and glycolipids.

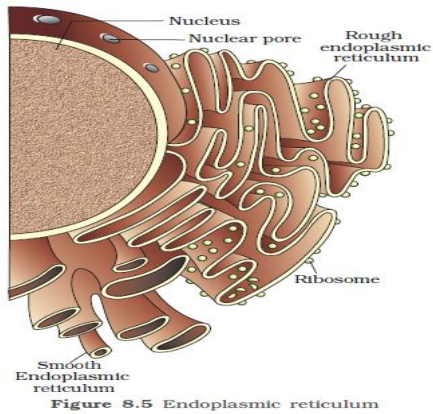


Figure 8.5 Endoplasmic reticulum

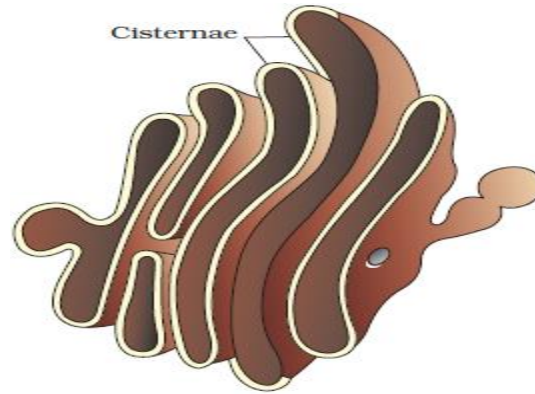


Figure 8.6 Golgi apparatus

Lysosomes

Lysosomes are membrane bound vesicular structures formed by the process of packaging in the Golgi apparatus. They are rich in hydrolytic enzymes- lipase, protease, carbohydrases active at acidic PH. These enzymes are capable of digesting carbohydrates, proteins, lipids and nucleic acids.

Vacuoles

Vacuoles are membrane bound space found in cytoplasm containing water, sap and excretory product. They are bound by single membrane. They form contractile vacuole and food vacuole in many organisms. Membrane is known as tonoplast

Mitochondria -

Power house of the cell – sites of aerobic respiration, produce energy capsules ATP, double membrane structure, inner compartment is known as Matrix.

Inner membrane forms a number of infoldings called Cristae to increase the surface area. Matrix possesses single circular DNA, few RNA and ribosomes (70S).

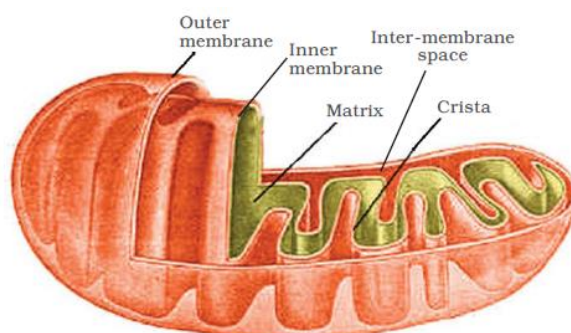
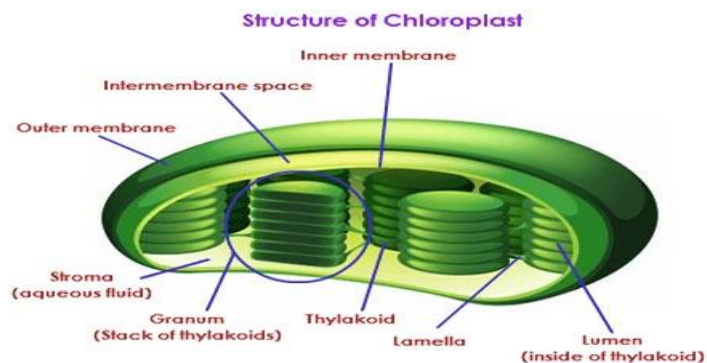


Figure 8.7 Structure of mitochondrion (Longitudinal section)

Plastids

Three types –Chloroplast (perform photosynthesis), Chromoplast (give colors to petals) and Leucoplasts (store food)

Leucoplasts - amyloplasts, (store starch); Elaioplasts (store oil/fat), Aleuroplasts (store proteins)



Ribosomes (George Palade)

Composed of RNA and proteins.

Eukaryotic ribosomes are 80 S 'S' stand for the sedimentation coefficient (Svedberg's unit).

Site of protein synthesis.

Cytoskeleton

Network of filamentous proteinaceous structures in the cytoplasm. Made up of microtubules and micro filaments.

Functions:- Mechanical support, motility, maintenance of the shape of the cell.

Cilia and flagella

Core is called axoneme - has 9 pairs of doublets of microtubules on periphery and one pair in the centre 9+2 array emerged from centriole like structure called the Basal bodies.

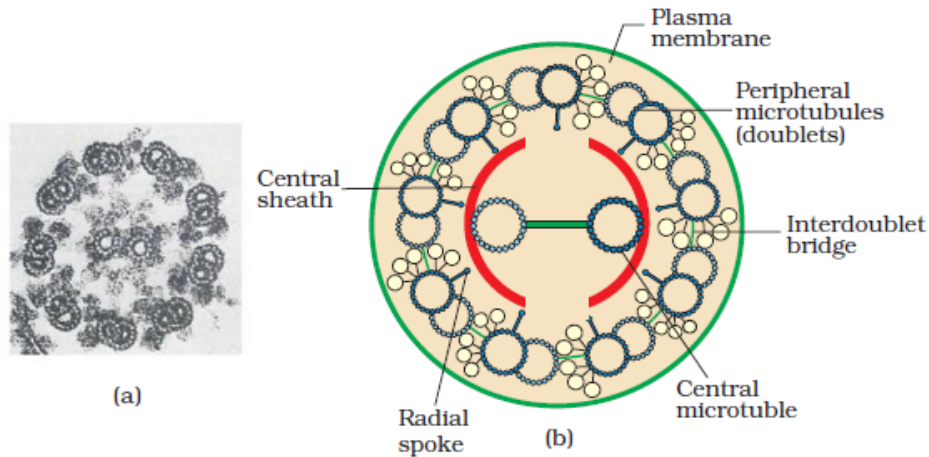


Figure 8.9 Section of cilia/flagella showing different parts : (a) Electron micrograph (b) Diagrammatic representation of internal structure

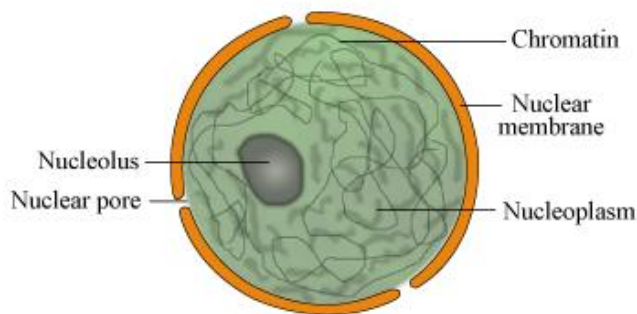
Centrosome_and centrioles

Centrosome contains 2 centrioles .

Each centriole has a cart wheel like organization with 9 evenly spaced microtubule.

Triplets connected to central hub by radial spokes – produces spindle apparatus during cell division

Nucleus (Robert brown,1831):



- Chromatin named by Flemming.
- Nucleoli – active ribosomal RNA synthesis
- Nucleoplasm – nucleolus + chromatin
- Nuclear membrane – with perinuclear space
- Chromosome – DNA + histone proteins
- Centromere –primary constriction – disc is known as kinetochores
- No nucleus in erythrocytes (RBC) of mammals and sieve tube cells in vascular plants
- Based on the position of centromere
- Metacentric, sub-metacentric, acrocentric, telocentric

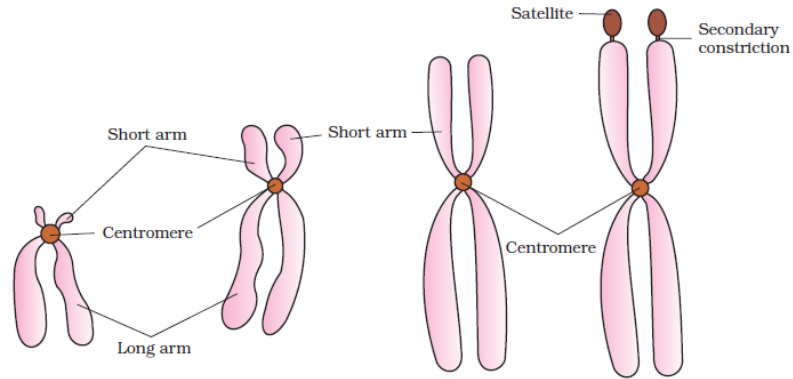


Figure 8.12 Types of chromosomes based on the position of centromere

Microbodies: Minute vesicles containing various enzyme (in plant and animal cell).

